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<p>(21) International Application Number: PCT/GB96/02411 (22) International Filing Date: 1 October 1996 (01.10.96) (71) Applicant (for MW only): GHELANI, Meena, Paresh [GB/GB]; 2 Priory Close, Off Fosse Way, Syston, Leicester LE7 1RY (GB). (71)(72) Applicant and Inventor: KAPADIA, Suresh, Babubhai [IN/IN]; B.C.S. Security Products Pvt. Ltd., Tilak Path, Nasik (IN). (74) Agent: JONES, Stephen, Anthony; Lewis & Taylor, 144 New Walk, Leicester LE1 7JA (GB).</p>		<p>(81) Designated States: AL, AM, AT, AU, AZ, BB, BG, BR, BY, CA, CH, CN, CZ, DE, DK, EE, ES, FI, GB, GE, HU, IL, IS, JP, KE, KG, KP, KR, KZ, LK, LR, LS, LT, LU, LV, MD, MG, MK, MN, MW, MX, NO, NZ, PL, PT, RO, RU, SD, SE, SG, SI, SK, TJ, TM, TR, TT, UA, UG, US, UZ, VN, ARIPO patent (KE, LS, MW, SD, SZ, UG), Eurasian patent (AM, AZ, BY, KG, KZ, MD, RU, TJ, TM), European patent (AT, BE, CH, DE, DK, ES, FI, FR, GB, GR, IE, IT, LU, MC, NL, PT, SE), OAPI patent (BF, BJ, CF, CG, CI, CM, GA, GN, ML, MR, NE, SN, TD, TG).</p> <p>Published <i>With international search report.</i></p>
<p>(54) Title: PAPER SIZING</p> <div data-bbox="324 1134 1331 1470"> </div> <p>(57) Abstract</p> <p>Treatment of paper during manufacture or afterwards with a chemical formulation improves the Cobb value of the paper, and its tensile strength. The treatment may be performed during manufacture of the paper. Alternatively, the treatment may be carried out on finished paper, or on paper products such as packaging items. The chemical formulation comprises organic solvents and is preferably a dispersion of a polymer in a mixture of such solvents. The process of the invention is particularly useful in relation to security papers such as are used for banknotes etc.</p>		

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Title - PAPER SIZING

This invention relates to a process for the chemical treatment of paper, a chemical formulation utilized in that process, and to novel paper products.

Paper has been used for centuries, for mainly three purposes. First, paper is used to record thoughts or ideas by way of printing and writing. Secondly, paper is used as packaging or as packaging articles such as labels or cartons and bags paper. Thirdly, paper is also used as a medium of exchange in the form of printed currency, banknotes, cheques etc.

For many paper products it is desirable that the lifetime of the paper should be as long as possible. One example is items such as banknotes which are frequently handled and folded or rolled. Another example is paper used in documents such as passports or share certificates which are valuable and contain information which must be preserved over lengthy periods of time.

There is therefore a need for long-lasting paper which will maintain its integrity over a long period of storage and/or after repeated handling. To date, however, this requirement has not been fully satisfied. Conventional papers normally absorb water or moisture to a considerable extent, with the result that the paper becomes soft and easy to tear, and also may spoil the contents of packaging in which it is used. The absorption of moisture also has an adverse effect on the other properties of the paper. For instance, it may be difficult or impossible to print or write on the paper and/or existing printed or written material may fade or become illegible. Paper used as packaging may fall apart or become torn; paper used in currency may have a short lifetime.

One approach to this problem which is used is to coat paper with a varnish. This gives the paper a shiny appearance but is not waterproof and also gives no additional strength to the papers. More recently, processes have been developed to wax papers. The quality of printing and writing on a waxed paper is of reduced quality, and bonding of such papers is also not good.

Another coating process comprises laminating the paper with plastic films such as PVC, polyester, HDP etc. However, these processes suffer from similar disadvantages to waxing.

Lastly, plastic papers are known which, whilst they are sturdy and waterproof and give good printing, are expensive and therefore not popular. Plastic paper is costly and writing on plastic paper is not feasible.

There has now been devised a process for the manufacture or treatment of paper or paper products which overcomes or substantially mitigates the above disadvantages, a chemical formulation for use in that process, and improved paper products.

According to a first aspect of the present invention, a process for the manufacture or treatment of paper or a paper product comprises applying to the paper or paper product, either during manufacture or subsequently, a chemical formulation which confers waterproofing or water-repellent properties on the paper.

The process according to the invention is advantageous in that the paper produced by the process has improved, ie reduced, water-absorbing characteristics compared with conventional papers. In particular, the products of the process may have reduced Cobb values, as well improved tensile strength and so-called "burst factor". Consequently, the products may be more durable than conventional papers and increased lifetime.

According to a second aspect of the invention, there is provided a chemical formulation for use in the manufacture or treatment of paper or paper products, the formulation being capable of reducing the water-absorbing properties of the paper or paper products.

The formulation preferably comprises a dispersion or solution of a polymer or polymer precursor in an organic solvent or mixture of organic solvents.

Any suitable polymer may be used. The formulation is preferably a dispersion of a polymer in a mixture of organic solvents. The solids content of the formulation is preferably greater than 5% w/w and less than 30% w/w. Typically, the solids content is 10-15% w/w. The polymer is most preferably a graft copolymer.

The formulation preferably contains a mixture of organic solvents. The solvents preferably include aromatic solvents such as xylene and toluene. Most preferably, the components of the mixture may be present in approximately equal proportions. The formulation may also incorporate further organic components. One such further component is methyl isobutyl ketone.

Typically, the formulation according to the invention has the following characteristics:

Flash point	28°C ± 4°C
Solid content	10.5-12.5% w/w
pH	9-10

The process of the invention may be applied to any and all types of paper. The process may be applied during manufacture of the paper or paper product at any suitable stage. Alternatively, the process may be applied to a conventional paper at the end of the normal manufacturing process, or subsequently. The process may also be applied to completed paper products, eg assembled paper packaging units such as envelopes, boxes or cartons. Depending on the application, the external and/or internal surfaces of such packaging may be treated in accordance with the invention. Where the packaging is made of laminated papers, the external and/or internal layers may be produced from papers treated in accordance with the invention.

The process of the invention may be of particular utility in relation to security papers for use in, for instance, banknotes. Particularly in less developed countries the lifetime of banknotes may be very short (eg no more than a few months) and the regular replacement of banknotes in circulation represents a very costly matter. By extending the lifetime of banknotes by treatment in accordance with the process of the invention very considerable savings may be made.

Security papers subjected to the process of the invention may also incorporate other security features, eg watermarking, security threads etc.

Waterproof or water-repellent security papers and items, eg banknotes, produced from them represent a further novel aspect of the present invention.

The process of the invention may be applied to any kind of paper made of any kind of pulp or cotton comber, before calendering or final processing. In the case of security papers, the process may be applied before or after application of a watermark, eg by cylinder mould, four dinier or other process. Similarly, the process may be applied before or after full or alternate embedding or window threading of any type of security thread, eg comet, continuous printed or unprinted, metallised or demetallised, positive text or negative text, magnetic or machine-readable threads etc. Coating by the process of the invention may also take place before or after incorporation of UV- detectable fibres.

The process may also be applied after the paper is calendered and ready for use or printing.

The process may be applied to all types of plain or printed papers, including currency, posters or packaging, before or after printing by any type of printing ink, including intaglio, magnetic, short-wave, UV, etc.

Treated papers produced by the process of the invention may be used for any purpose, eg as currency (banknotes) of all denominations, secured documents, security papers, cheques, packaging papers. Papers for use in packaging may be converted into corrugated boxes, cartons, bags, or special purpose moisture-controlling packaging for soaps, detergents, medicines, processed and unprocessed food articles, fruit and vegetables, etc.

The chemical formulation of the invention may be applied by various means, eg using a conventional varnishing machine, gravure machine, brush coating, dip coating or any other method of coating, or on-line during manufacture of the paper.

The process may be applied to any and all types of papers including banknote paper, security papers, craft papers, chromo-art, maplitho, yugoart, currency papers with or without security features. Plain or printed papers may be treated in the required quantity depending upon the requirements, in roll, sheet, container or any other desired form.

The application of the process of the invention will now be illustrated by means of the

accompanying drawing which shows schematically the stages in the production of a security paper containing a watermark and security thread.

Referring to the drawing, a manufacturing line and process for a security paper incorporating a watermark and security thread (eg suitable for the printing of banknotes) contains the following stages:

- 1 roll of security thread
- 2 cylinder mould, dandee roll or the like for watermarking
- 3 vat
- 4 sizing
- 5 drying
- 6 sizing
- 7 PVA/Gelatin bath
- 8 drying
- 9 steaming
- 10 on-line coating machine for application of waterproofing formulation
- 11 calendering
- 12 calendering
- 13 finishing
- 14 finished roll sheet

In the arrangement illustrated, the formulation of the invention is applied at the point 10, using an on-line coating machine.

Alternatively, the process may be applied at other stages. For example, the treatment may be applied between stages 4 and 5, between stages 5 and 6, stages 8 and 9, stages 11 and 12, stages 12 and 13, stages 13 and 14, or subsequent to stage 14.

The process of the invention, comprising treatment of the paper with the chemical formulation of the invention, may also replace the PVA/gelatin bath at stage 7.

It will be understood that the process of the invention may be applied at any suitable stage of the paper manufacturing process. In other paper manufacturing processes the sequence and methods of operations may be different to that illustrated, and the precise point at which the treatment according to the invention is carried out will generally not be important.

Claims

1. A process for the manufacture or treatment of paper or a paper product, comprising applying to the paper or paper product, either during manufacture or subsequently, a chemical formulation which confers waterproofing or water-repellent properties on the paper.
2. A process as claimed in Claim 1, wherein the treatment is made during manufacture of the paper.
3. A process as claimed in Claim 2, wherein the treatment is performed on-line during manufacture of the paper.
4. A process as claimed in Claim 2, wherein the treatment is performed subsequent to manufacture of the paper.
5. A process as claimed in Claim 2, wherein the treatment is performed on an assembled paper product.
6. A process as claimed in any preceding claim, wherein the formulation comprises a dispersion or solution of a polymer or polymer precursor in an organic solvent or mixture or organic solvents.
7. A process as claimed in Claim 6, wherein the formulation is a dispersion of a polymer in a mixture of organic solvents.
8. A process as claimed in Claim 6 or Claim 7, wherein the solids content of the formulation is greater than 5% w/w and less than 30% w/w.
9. A process as claimed in any one of Claims 6 to 8, wherein the polymer is a graft copolymer.

10. A process as claimed in any one of Claims 6 to 9, wherein the mixture of solvents contains xylene and toluene.

11. A process as claimed in Claim 10, wherein the xylene and toluene are present in approximately equal proportions.

12. A process as claimed in any one of Claims 1 to 11, wherein the formulation has the following characteristics:

Flash point	28°C ± 4°C
Solid content	10.5-12.5% w/w
pH	9-10

13. A chemical formulation for use in the manufacture or treatment of paper or paper product, the formulation being capable of reducing the water-absorbing properties of the paper or paper products.

14. A formulation as claimed in Claim 13, wherein the formulation comprises a dispersion or solution of a polymer or polymer precursor in an organic solvent or mixture of organic solvents.

15. A formulation as claimed in Claim 14, wherein the formulation is a dispersion of a polymer in a mixture of organic solvents.

16. A formulation as claimed in Claim 15, wherein the solids content of the formulation is greater than 5% w/w and less than 30% w/w.

17. A formulation as claimed in Claim 15 or Claim 16, wherein the polymer is a graft copolymer.

18. A formulation as claimed in any one of Claims 15 to 17, wherein the mixture of solvents

contains xylene and toluene.

19. A formulation as claimed in Claim 18, wherein the xylene and toluene are present in approximately equal proportions.

20. A formulation as claimed in any one of Claims 13 to 19, which has the following characteristics:

Flash point	28°C ± 4°C
Solid content	10.5-12.5% w/w
pH	9-10

21. A waterproof or water-repellent paper.

22. An item produced from a paper as claimed in Claim 21.

23. An item as claimed in Claim 22, which is a banknote.

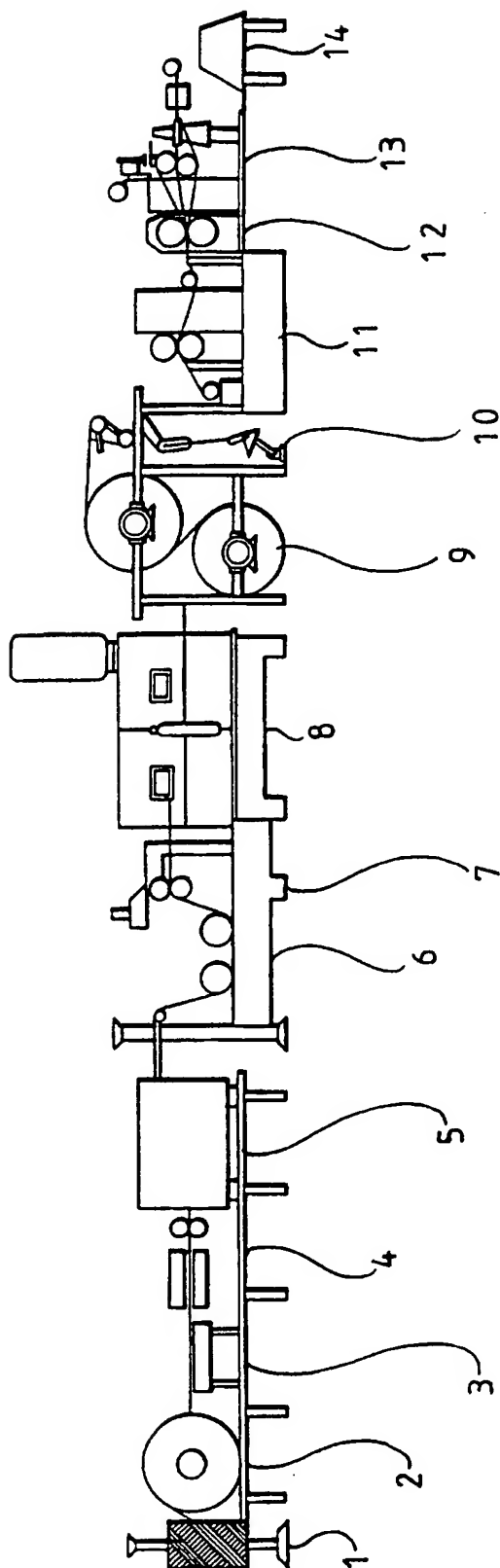
24. An item as claimed in Claim 22 or Claim 23, which incorporates a watermark.

25. An item as claimed in Claim 22 or Claim 23, which incorporates a security thread.

26. An item as claimed in Claim 22 or Claim 23, which incorporates UV-detectable fibres.

27. Packaging incorporating a paper as claimed in Claim 21.

1 / 1



INTERNATIONAL SEARCH REPORT

International Application No

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A. CLASSIFICATION OF SUBJECT MATTER
IPC 6 D21H21/16 B42D15/00 D21H27/10 B65D65/00

According to International Patent Classification (IPC) or to both national classification and IPC

B. FIELDS SEARCHED

Minimum documentation searched (classification system followed by classification symbols)
IPC 6 D21H B42D B65D

Documentation searched other than minimum documentation to the extent that such documents are included in the fields searched

Electronic data base consulted during the international search (name of data base and, where practical, search terms used)

C. DOCUMENTS CONSIDERED TO BE RELEVANT

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